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*not  
related  
"gun"*

## (54) A GUN FOR FIRING TACKS

(71) I, UMBERTO MONACELLI, of Via Solferino, 31-Udine, Italy, a citizen of Italy, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a gun for driving tacks or other headed nails, which shall be referred to hereinafter as tacks for simplicity.

Compressed air guns are available which first staples, driving them into the wood or other material, which staples are fed to a firing channel in which they are guided during their travel following the blow imparted by a hammer or percussion pin thrust by the compressed air.

A disadvantage of these compressed air guns however is that they are unsuitable for use with tacks, particularly the common tacks used by upholsterers. In this case it often happens that the heads of the tacks, as they slide along the guide walls of the firing channel, become removed, deformed or inclined relative to the firing channel with the result that the tacks are made to emerge with their shank oblique with respect to the required direction.

An object of the present invention is to obviate or mitigate the above disadvantage.

According to the present invention there is provided a gun for driving tacks into a material, comprising a barrel which in use, is fed with tacks, a percussion hammer movable in the barrel to thrust the tacks out through the mouth of the barrel, support members for supporting the head of the tack being driven, which support members are attached to the hammer and movable with the hammer along the barrel, means for maintaining said support members in a position supporting the head of the tack being driven during part of the driving stroke of the hammer, means for permitting automatic movement of said support members into a non-supporting position dividing the remainder of the driving stroke of the hammer, to thereby free the head of the tack and allow

the tack to proceed freely into the material under the thrust of the hammer. 50

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which: 55

Fig. 1 is a partially sectional side view of a first embodiment of a gun according to the invention;

Fig. 2 is a sectional view on the line II—II of Fig. 1, with the percussive hammer in the rest position; 60

Fig. 3 is a sectional view on the line III—III of Fig. 2;

Fig. 4 is a frontal elevation of two joined plates which form the barrel of the gun shown in the preceding Figs.; 65

Fig. 5 is an elevation of one of the plates of Fig. 4 from within;

Fig. 6 is an elevation of the other plate from within; 70

Fig. 7 is a plan view from below of the assembly comprising the two plates;

Fig. 8 is a sectional view of the type shown in Fig. 2, but with the percussion hammer advanced to the position in which the support members are opened for discontinuing the supporting action for the head of the tack, whose shank is already partially driven into the material to be riveted; 75

Figs. 9 and 10 are sectional views similar to those of Figs. 2 and 8, but show a second embodiment of the gun according to the invention; 80

Fig. 11 is a sectional view on the line XI—XI of Fig. 9; 85

Figs. 12 and 13 are sectional views similar to those of Figs. 2, 8 and 9, 10 but show a third embodiment of the gun according to the invention;

Figs. 14 and 15 are sectional views which show a fourth embodiment of the gun according to the invention with the percussion hammer in the two extreme conditions, namely the rest position and position of maximum advancement for driving the tack into the material to be riveted. 90

The gun shown in Figs. 1—8 comprises essentially a working head 1 operated by

compressed air, a barrel 2, a magazine 3 for loading the tacks into the barrel, an arm 4 for feeding compressed air to the head 1, a nipple 5 for connecting the arm 4 to a source of compressed air (not shown), an operating trigger 6 and a grip 7.

The working head 1 comprises a cylinder 8 which is fed at its upper end with compressed air supplied to it by the feed arm 4 by way of a valve 9 (see Italian Patent No. 726,337) and a pad 10 which acts as a stop for a piston 11 which slides within the cylinder 8 and is provided with a cylindrical rod 12 which constitutes the percussion hammer of the gun. Inside the percussion hammer 12, a cylindrical rod 13 is disposed axially and provided with two enlarged end heads 14 and 15, by way of the first of which it is adjustable attached to the piston 11. A bush 16 is slidably mounted on the rod 13 and is thrust by means of a spring 17, wound about the rod 13 and interposed between the bush 16 and enlarged head 14, towards the enlarged head 15. The upper ends 19 of two support members comprising two jaws 20 are inserted between the bush 16 and enlarged head 15, passing through respective diametrically opposed apertures 18 in the percussion hammer 12. As can be seen from Figs. 2 and 8, these upper ends 19 are bent inwardly so as to form an angle of approximately 120° with respect to the middle portions of the jaws. The lower ends 21 are bent at right angles inwardly with respect to the same middle portions.

Both the lower end portion of the percussion hammer 12 and almost the whole length of the jaws 20 always travel within the barrel 2, which presents a cylindrical passage 22 along which the percussion hammer 12 slides and a pair of diametrically opposed grooves 23, of rectangular section, along which the jaws 20 slide.

As shown in Figs. 2 and 8, these grooves 23 extend with a constant section in their upper portion and then diverge substantially frusto-conically as they approach the mouth 24 of the barrel 2, from which they are separated by a pair of diametrically opposed stops 25.

The barrel 2 is formed by joining together two almost equal plates 2a, 2b (Figs. 3-7) which comprise rounded grooves 22a, 22b respectively, which when joined together form the cylindrical passage 22, square grooves 23a, 23b respectively, which when joined together form the grooves 23, projections 25a, 25b respectively, which when joined together form the stops 25 and external cavities 26a, 26b respectively which allow the firing head of the gun to rest on the head of an already driven tack in order to drive tacks very closely together. The plate 2b also comprises a T-shaped opening 27 which communicates with the outlet of

the magazine 3 so as to allow tacks to be introduced into the barrel 2.

With the structure heretofore described, when a tack 28 is fed from the magazine 3 to the barrel 2 through the T-shaped opening 27, its head 29 goes to rest on the lower ends 21 of the jaws 20, which are maintained in the closed position by the opposing action between the middle portions and the non-diverging upper portions of the grooves 23, and is thus maintained in a suspended position with the shank 30 facing downwards (Fig. 2).

In order to fire the tack into a layer 31 of material to be riveted, it is sufficient to push the trigger 6. On doing this, compressed air is introduced into the upper chamber of the cylinder 8 (as described in the aforementioned Italian Patent No. 726,337), which causes rapid movement of the piston 11 and consequent advancement of the percussion hammer 12 in the barrel 2 with the jaws 20 supporting the tack. Since the upper portion of the grooves 23 is of constant section, the jaws 20 are initially maintained in the closed position in spite of the opening thrust which the spring 17 exerts on the upper inclined ends of said jaws. Thus, during the first part of its journey, the tack 28 is supported and guided so as to avoid any undesirable separation, tilting or deformation of its head 29 and at the same time ensures its advancement perfectly perpendicular to the layer 31 of material to be riveted. When the jaws 29 arrive at the lower diverging portions of the grooves 23, the opening of the jaws 20 due to the force of the spring 17 is no longer opposed and the jaws 20 open, freeing the tack 28 which proceeds on its journey thrust only by the percussion hammer 12, whereas the jaws 20 stop against the stops 25 (their upper ends 19 slide in the openings 18 of the percussion hammer, compressing the spring 17, which thus acts as a shock absorber). As shown in Fig. 8, the jaws 20 open only shortly before the end of the advancing journey of the tack and in particular when the shank of the tack has already partially been driven into the material 31, i.e. when it is no longer necessary to exert a guide action on the tack.

After the advancement stroke of the percussion hammer 12 and hence when the tack has already been completely driven into the material 31, the piston 11 is returned (Italian Patent No. 726,337) into the starting position of Fig. 2 and consequently the percussion hammer 12 rises and the jaws 20, re-entering the portion of the grooves 23 of constant section, close again and arrange themselves for supporting a new tack fed from the magazine 3.

It should be noted that the magazine 3 has not been described in detail and will not be hereinafter. This is due to the fact that

it forms the subject matter of copending British Patent Application No. 57746/71 (Serial No. 1,358,600) in the name of the same Applicant, to which reference is made for its more detailed description. With regard to the description of the gun according to the present invention it is sufficient to know that the magazine comprises essentially a feed channel 32 communicating with the opening 27 of the barrel 2, in which magazine the tacks 28 are disposed in a row with their heads one against the other, and a pusher 33 which is pulled against the row of tracks by a spring 34 so as to thrust them towards the opening 27.

The gun shown in Figs. 9—11 is analogous to that of Figs. 1—8 with the exception that the upper ends 19 of the jaws 20 (similar parts of the two embodiments are indicated by the same reference numerals) are bent at 90° instead of 120° with respect to the middle portions of the respective jaws, and that said upper ends 19 each comprise a tooth 35 facing outwards which slides in a groove 36 formed in the bottom of the respective groove 23, keeping the jaw 20 in its closed position until the tooth meets a stop 37 which causes the jaw 20 to partially tilt and consequently open in the lower diverging portion of the groove 23 (Fig. 10). The grooves 36 are formed by joining together the grooves 36a, 36b respectively of the two plates 2a, 2b, and the stops 37 are formed by joining together the stops 37a, 37b, respectively of said plates.

The function of the stops 37 in relation to the teeth 35 in the embodiment shown in Figs. 9—11 is alternatively effected by the stops 25 (with the upper edge suitably inclined) in relation to the lower ends 21 (with the lower edge suitably inclined) of the jaws 20 in the embodiment shown in Figs. 12—13 (the lower diverging portions of the grooves 23 prevent excessive opening of the jaws, which could otherwise cause them to leave the firing channel through the openings between the lower ends of the grooves 23 and the stops 25, and the consequent continuation of travel of the jaws), which for the remainder is entirely analogous to those of Figs. 1—8 and 9—11 and consequently carries the same reference numerals.

Some differences exist in the embodiment shown in Figs. 14—15, in which, inside the working head 51, there is a lower chamber 54 and an upper chamber 61 which can be connected alternately (by known means) to the supply of compressed air and to discharge. Inside the two chambers 54 and 61, separated by a gasket ring 63, there is a cylinder 58 inserted whose interior communicates with the chamber 54 through holes 64, 65 and 66, and with the chamber 61 through a hole 67. Inside the cylinder 58, which is closed at its lower end by a pad 60

and opened and closed at its upper end by a valve 59, two pistons 82 and 83 are slidably housed one sliding within the other (sealed by a gasket ring 85) so as to define an intermediate chamber 84 which communicates through a hole 86 with an annular chamber 87 defined between the external piston 82, the wall of the cylinder 58 and the two gasket rings 88 and 89.

A cylindrical rod 62 is rigid with the piston 83, and to its lower end there are hinged the upper ends 69 (bent at right angles inwardly of two jaws 70 with their angles inwardly) of two jaws 70 with their lower ends 71 bent at right angles inwardly and their middle portions comprising a cam 68 projecting inwardly. The two jaws 70 are housed in the internal passage of a barrel 52 similar to the barrel 2 of the embodiment shown in Figs. 1—8 and consequently provided with a cylindrical passage 72, two grooves 73 of constant upper section and diverging lowerly, and two stops 75 which separate the grooves 73 from the mouth 74 of the barrel 52. In this case the barrel 52 is also formed by joining together two almost equal plates, one of which comprises a T-shaped opening 77, through which a magazine 53 feeds tacks 78 composed of a head 79 and a shank 80.

A rod 55 is fixed to the piston 82 by means of a nut 90 and is provided with two enlargements for sealing and guiding, 91 and 57, and an enlarged end head 56. The rod 55 is housed within the piston 83 and the rod 62, with the exception of the enlarged end head 56 which remains below the lower end of the rod 62.

In operation, the starting condition is that shown in Fig. 14, with the chamber 61 connected to the compressed air supply, the chamber 54 connected to discharge and the valve 59 in the closed position. Compressed air then enters the chamber 84 through the communicating holes 67 and 86 and holds the pistons 82 and 83 apart at the upper end of the cylinder 58, consequently maintaining the head 56 in the raised position, and the jaws 70 inserted in the upper portion of constant section of the grooves 73 so that they are closed in order to support the head of a tack 78 fed from the magazine 53 through the opening 77.

In order to fire the tack into the material 81, it is sufficient to raise the valve 59. The compressed air then thrusts the piston 82 downwards and consequently also the piston 83 (which is kept apart by the compressed air imprisoned in the chamber 84), because of which the rod 62 with the jaws 70 and the rod 55 with the percussion pin 56 advance in the barrel 52 towards the mouth 74 of the barrel 52. Movement of the two pistons proceeds in this manner until the hole 86 of the piston 82 reaches a position

corresponding with the hole 66 of the cylinder 58. At that point the compressed air imprisoned in the chamber 84 flows to discharge, and whereas the piston 83 stops against the pad 60, the piston 82 proceeds on its stroke until it comes into contact with the piston 83. At this point, the rod 62 stops but the rod 55 continues to move down the barrel such that the head 56 strikes the cams 68 of the jaws 70, so causing them to open. The opening of the jaws 70, permitted because said jaws reach the lower diverging portion of the grooves 73, releases the head of the tack 78, which thus proceeds on its driving journey under the thrust only of the percussion head 56 (Fig. 15). In this case, by suitably arranging the hole 66 and the diverging portions of the grooves 73, it is also possible for the tacks to be freed only when the shank 18 has already been partially driven into the material 81.

For the return, when the compressed air has been discharged from the cylinder 58 (Italian Patent No. 726,337), compressed air again enters the chamber 84 from the chamber 54 through the holes 65 and 86 to separate the pistons 82 and 83, then the compressed air entering through the holes 64 raises the two pistons rigidly so that they return to the raised position shown in Fig. 14.

#### WHAT I CLAIM IS:—

1. A gun for driving tacks into a material comprising a barrel which, in use is fed with tacks, a percussion hammer movable in the barrel to thrust the tacks out through the mouth of the barrel, support members for supporting the head of the tack being driven, which support members are attached to the hammer and movable with the hammer along the barrel, means for maintaining said support members in a position supporting the head of the tack being driven during part of the driving stroke of the hammer, means for permitting automatic movement of said support means into a non-supporting position, during the remainder of the driving stroke of the hammer, to thereby free the head of the tack and allow the tack to proceed freely into the material under the thrust of the hammer.

2. A gun as claimed in claim 1, wherein the means for permitting the support members to move automatically into the non-supporting position are located in the barrel in such a position that the shank of the tack is partially inserted into the material before the head of the tack is released from the support members.

3. A gun as claimed in claim 2, wherein the means for maintaining the support members in a supporting position comprises a first pair of channels in the barrel, the cross sections of which are constant, and the

means for permitting the support members to move automatically into the non-supporting position comprises a second pair of channels in the barrel, the cross sections of which channels increase towards the mouth of the barrel.

4. A gun as claimed in claim 3, including resilient means which act on the support members so as to thrust them towards the non-supporting position on their arrival at the second pair of channels in the barrel.

5. A gun as claimed in claim 4, wherein the percussion hammer comprises a shaft within which is housed a rod with enlarged end portions, the resilient means comprises a helical spring wound around said shaft and acts between one of the enlarged end portions and a bush which is slidably mounted on the rod, the support members comprise two jaws with their ends facing the mouth of the barrel bent inwards so as to constitute resting members for the head of the tack, and the opposing ends bent obliquely inwards and inserted between the sliding bush and the other enlarged end portion through longitudinally elongated openings in the shaft of the percussion hammer, the longitudinally elongated openings in the percussion hammer being aligned with the first pair and second pair of channels, and the barrel is provided with stop means at its mouth for the respective jaws of the support members for preventing the respective jaws from travelling beyond the mouth of the barrel.

6. A gun as claimed in claim 3, including stop means inserted in the path of advancement of the support members so as to cause them to move into the non-supporting position on their arrival adjacent the mouth of the barrel.

7. A gun as claimed in claim 6, in which said percussion hammer comprises a shaft within which is housed a rod with enlarged end portions about which is wound a helical spring acting between one of said enlarged end portions and a bush which slides on said rod, and in which said support members comprise two jaws with their ends facing the mouth of the barrel bent inwards so as to constitute resting members for the head of the tack, the opposing ends being bent inwards and inserted between said sliding bush and the other enlarged end portion of said rod through longitudinally elongated openings in the shaft of the percussion pin, and teeth projecting outwards adjacent said opposing ends, and two longitudinal grooves in which said teeth projecting from the jaws slide, said grooves extending together with said first pair of channels and terminating with end stops, which constitute said stop means, situated at the beginning of said second pair of channels.

8. A gun as claimed in claim 6, in which

said percussion hammer comprises a shaft within which is housed a rod with enlarged end portions about which is wound a helical spring acting between one of said enlarged end portions and a bush which slides on said rod, and in which said support members comprise two jaws having their ends facing the mouth of the barrel bent inwards so as to constitute resting members for the head of the tack, said ends having an edge facing the mouth of the barrel which edge diverges towards said mouth with respect to the longitudinal axis of the barrel, the opposing ends being bent inwards and inserted between said sliding bush and the other enlarged end portions of said rod through longitudinally elongated openings in the percussion hammer shaft, and a respective end stop, which constitute said stop means, with a striking face diverging outwardly with respect to the barrel axis for each jaw.

9. A gun as claimed in claim 3, in which said percussion hammer comprises a shaft slidable within said barrel and in which shaft a rod having an enlarged end portion is slidably mounted, and said support members comprise two jaws having their ends facing the barrel mouth bent inwards so as to constitute resting members for the head of the track and opposite ends hinged to said shaft, and each jaw has, intermediate its

ends, a cam element adapted to engage said enlarged end portion of the rod, and means for stopping the travel of the shaft towards the barrel mouth, said means being positioned such that the shaft is stopped at the start of said second pair of channels thereby allowing the rod to continue its movement towards the barrel mouth and act on said cam elements to open said jaws and release the head of the tack.

10. A gun substantially as hereinbefore described with reference to Figs. 1—8 of the accompanying drawings.

11. A gun substantially as hereinbefore described with the reference to Figs. 9—11 of the accompanying drawings.

12. A gun substantially as hereinbefore described with reference to Figs. 12 and 13 of the accompanying drawings.

13. A gun substantially as hereinbefore described with reference to Figs. 14 and 15 of the accompanying drawings.

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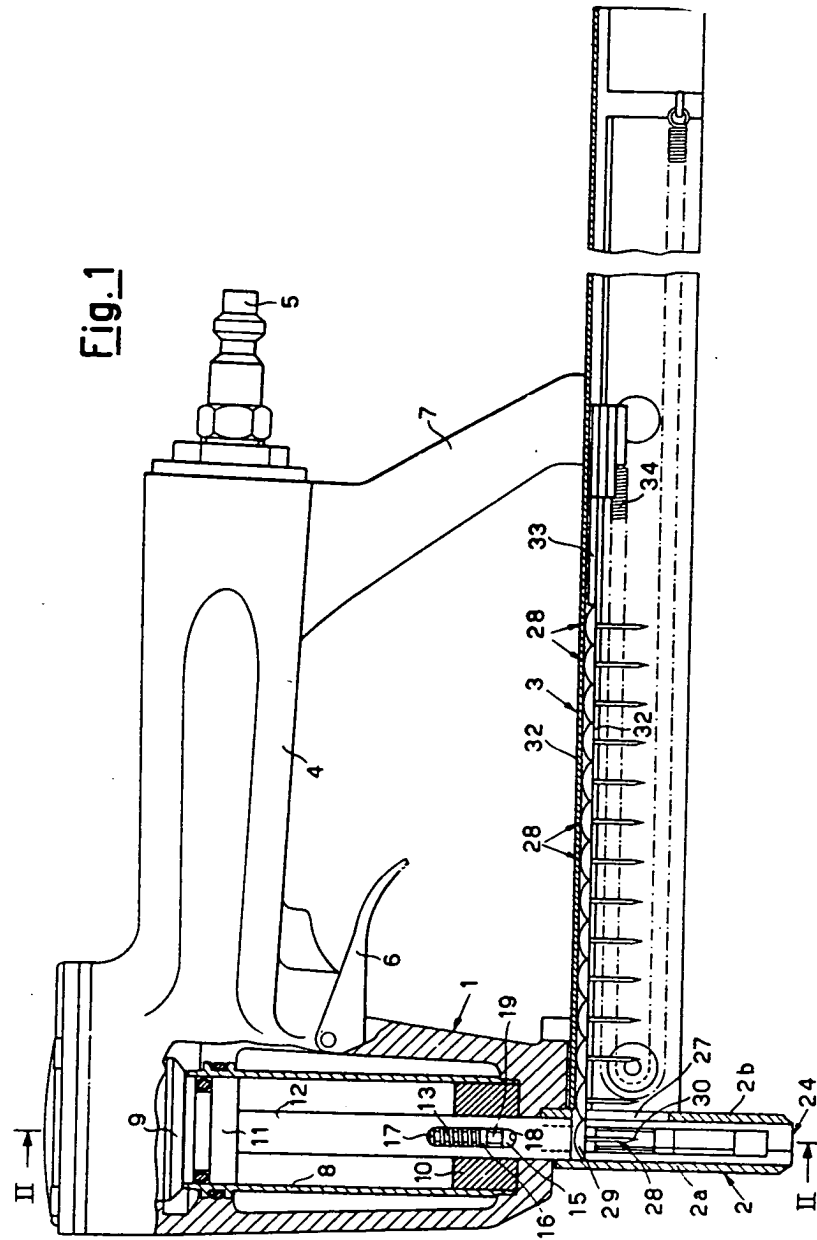


Fig. 2

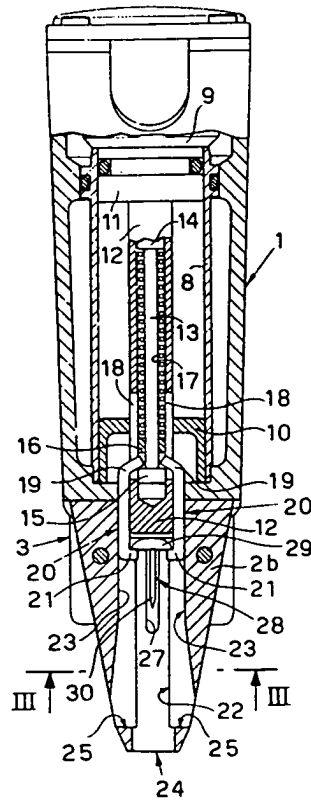


Fig. 8

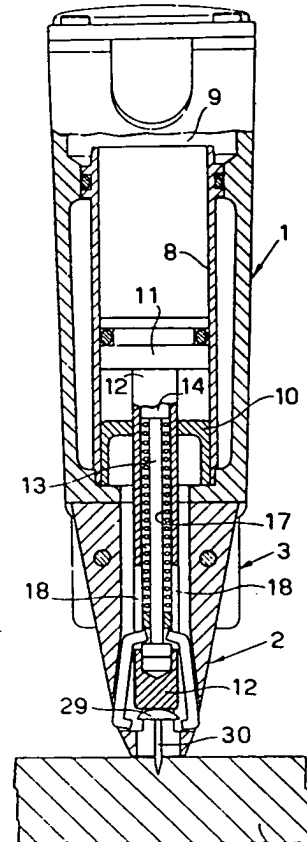


Fig. 3

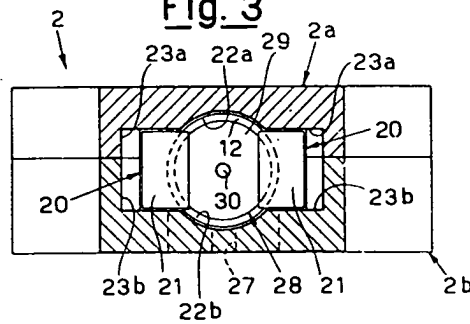


Fig. 4

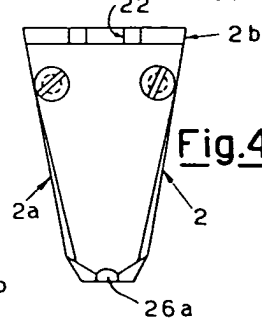


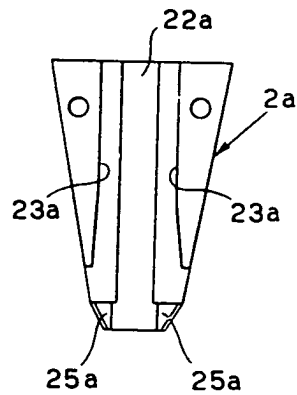
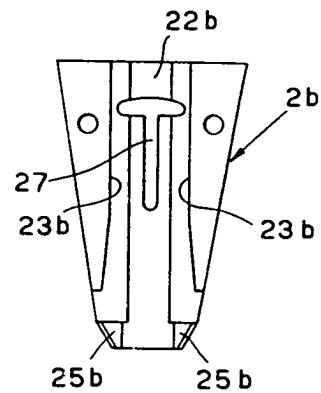
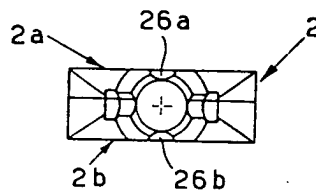
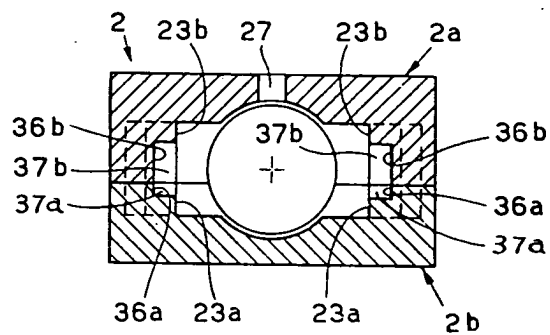
Fig. 5Fig. 6Fig. 7Fig. 11



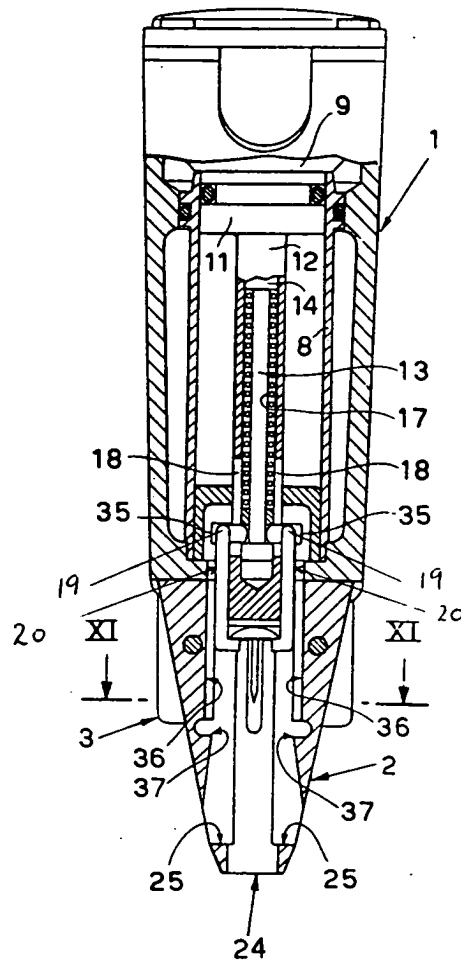
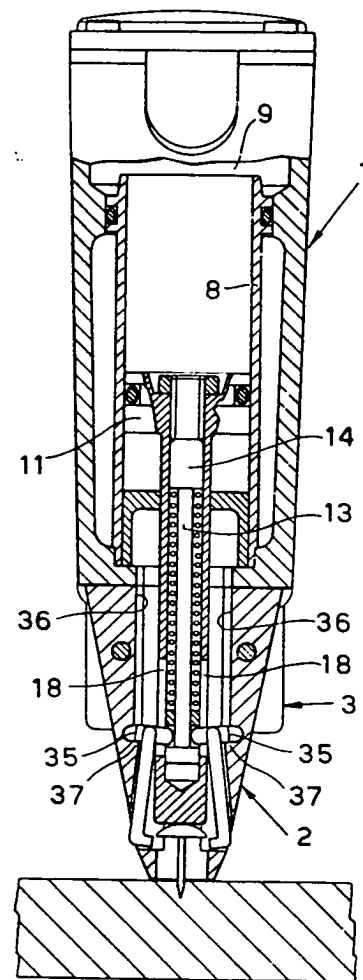
Fig. 9Fig. 10

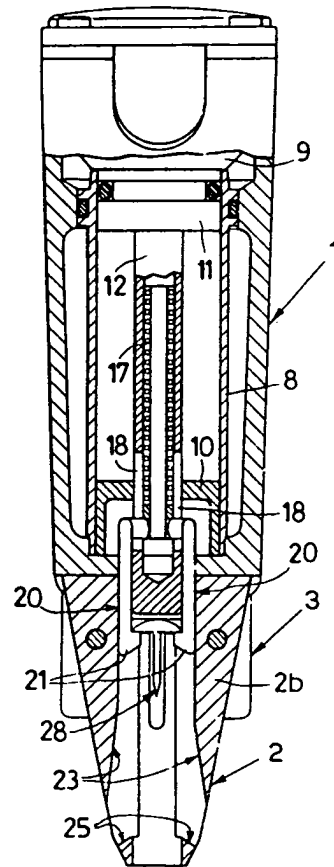
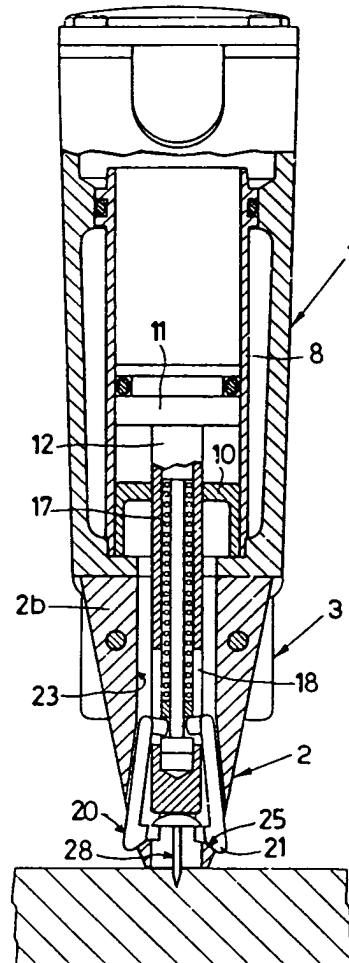
Fig.12Fig.13

Fig.14

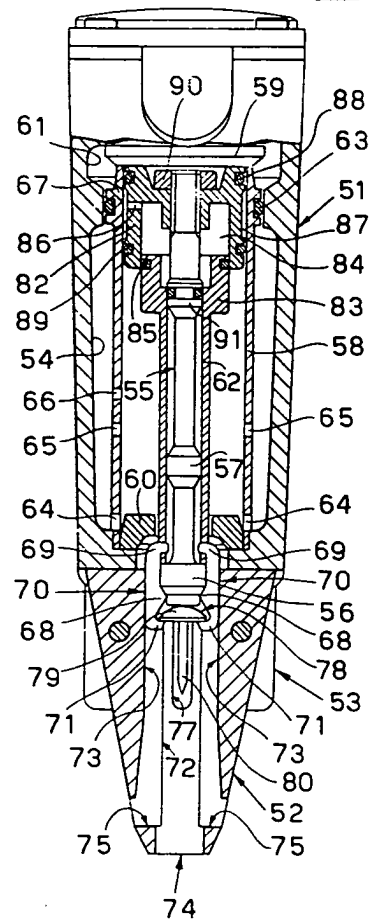


Fig.15

